

WHAT IS CLAIMED IS:

1 1. A ballistic magnetoresistive sensor, comprising:
2 a first pinned layer;
3 a first free layer;
4 a nickel nano-contact layer disposed between the pinned layer and the free layer;
5 and
6 a first and second lead layer disposed proximate to the pinned layer and free layer
7 respectively for providing a sense current that flows perpendicular to the planes of the
8 layers.

1 2. The ballistic magnetoresistive sensor of claim 1 further comprising layers
2 of tantalum disposed between the pinned layer and between the first lead and the free
3 layer and the second lead.

1 3. The ballistic magnetoresistive sensor of claim 1, wherein the first pinned
2 layer, first free layer, nickel nano-contact layer and first and second lead layers form a
3 nano-contact region.

1 4. The ballistic magnetoresistive sensor of claim 1 further comprising outside
2 structures disposed on opposite sides of the nano-contact region, the outside structures
3 comprising a second and third pinned layer, a second and third free layer, a first and
4 second insulation layer disposed between the second pinned layer and the second free
5 layer and between the third pinned layer and the third free layer, and outside lead layers
6 disposed proximate to the second and third pinned layers and the second and third free
7 layer.

1 5. The ballistic magnetoresistive sensor of claim 4, wherein the pinned layers
2 comprise a layer of nickel and a layer of cobalt iron (CoFe).

1 6. The ballistic magnetoresistive sensor of claim 4, wherein the free layers
2 comprise a layer of nickel iron (NiFe).

1 7. The ballistic magnetoresistive sensor of claim 1 further comprising layers
2 of tantalum disposed between the second pinned layer and one of the outside lead layers,
3 between the third pinned layer and one of the outside lead layers, between the second free
4 layer and one of the outside lead layers, and between the third pinned layer and one of the
5 outside lead layers.

1 8. The ballistic magnetoresistive sensor of claim 1, wherein the pinned layer
2 comprises a layer of nickel and a layer of cobalt iron (CoFe).

1 9. The ballistic magnetoresistive sensor of claim 1, wherein the free layer
2 comprises a layer of nickel iron (NiFe).

1 10. A magnetic storage device, comprising:
2 at least one magnetic storage medium;
3 a motor for moving the at least one magnetic storage medium;
4 a ballistic magnetoresistive sensor for reading data on the at least one magnetic
5 storage medium, and
6 an actuator assembly, coupled to the ballistic magnetoresistive sensor, for moving
7 the ballistic magnetoresistive sensor relative to the at least one magnetic storage medium,
8 the ballistic magnetoresistive sensor further comprising:
9 a first pinned layer;
10 a first free layer;
11 a nickel nano-contact layer disposed between the pinned layer and the free
12 layer; and
13 a first and second lead layer disposed proximate to the pinned layer and
14 free layer respectively for providing a sense current that flows perpendicular to the planes
15 of the layers.

1 11. The magnetic storage device of claim 10 further comprising layers of
2 tantalum disposed between the pinned layer and the first lead and between the free layer
3 and the second lead.

1 12. The magnetic storage device of claim 10, wherein the first pinned layer,
2 first free layer, nickel nano-contact layer and first and second lead layers form a nano-
3 contact region.

1 13. The magnetic storage device of claim 10 further comprising outside
2 structures disposed on opposite sides of the nano-contact region, the outside structures
3 comprising a second and third pinned layer, a second and third free layer, a first and
4 second insulation layer disposed between the second pinned layer and the second free
5 layer and between the third pinned layer and the third free layer, and outside lead layers
6 disposed proximate to the second and third pinned layers and the second and third free
7 layer.

1 14. The magnetic storage device of claim 13, wherein the pinned layers
2 comprise a layer of nickel and a layer of cobalt iron (CoFe).

1 15. The magnetic storage device of claim 13, wherein the free layers comprise
2 a layer of nickel iron (NiFe).

1 16. The magnetic storage device of claim 10 further comprising layers of
2 tantalum disposed between the second pinned layer and one of the outside lead layers,
3 between the third pinned layer and one of the outside lead layers, between the second free
4 layer and one of the outside lead layers, and between the third pinned layer and one of the
5 outside lead layers.

1 17. The magnetic storage device of claim 10, wherein the pinned layer
2 comprises a layer of nickel and a layer of cobalt iron (CoFe).

1 18. The magnetic storage device of claim 10, wherein the free layer comprises
2 a layer of nickel iron (NiFe).

1 19. A method for forming a ballistic magnetoresistive sensor, comprising:
2 forming a first free layer;
3 a nickel nano-contact layer disposed between the pinned layer and the free layer;
4 forming a first pinned layer; and
5 forming a first and second lead layer disposed proximate to the pinned layer and
6 free layer respectively for providing a sense current that flows perpendicular to the planes
7 of the layers.

1 20. The method of claim 19 further comprising forming layers of tantalum
2 between the pinned layer and the first lead and between the free layer and the second
3 lead.

1 21. The method of claim 19, wherein the forming the first pinned layer, first
2 free layer, nickel nano-contact layer and first and second lead layers further comprises
3 forming a nano-contact region.

1 22. The method of claim 19 further comprising:
2 forming outside structures disposed on opposite sides of the nano-contact region,
3 the forming the outside structures further comprising forming a second and third pinned
4 layer, forming a second and third free layer, forming a first and second insulation layer
5 disposed between the second pinned layer and the second free layer and between the third
6 pinned layer and the third free layer; and
7 forming outside lead layers disposed proximate to the second and third pinned
8 layers and the second and third free layer.

1 23. The method of claim 22, wherein the forming the pinned layers further
2 comprise forming a layer of nickel and a layer of cobalt iron (CoFe).

1 24. The method of claim 22, wherein the forming the free layers further
2 comprise forming a layer of nickel iron (NiFe).

1 25. The method of claim 19 further comprising forming layers of tantalum
2 between the second pinned layer and one of the outside lead layers, between the third
3 pinned layer and one of the outside lead layers, between the second free layer and one of
4 the outside lead layers, and between the third pinned layer and one of the outside lead
5 layers.

1 26. The method of claim 19, wherein the forming the pinned layer comprises
2 forming a layer of nickel and a layer of cobalt iron (CoFe).

1 27. The method of claim 19, wherein the forming the free layer comprises
2 forming a layer of nickel iron (NiFe).

1 28. A ballistic magnetoresistive sensor, comprising:
2 means for providing a pinned layer;
3 means for providing a free layer;
4 means for providing a nickel nano-contact layer disposed between the means for
5 providing a pinned layer and the means for providing a free layer; and
6 means for providing a first and second lead layer disposed proximate to the means
7 for providing the pinned layer and free layer respectively, the means for providing a first
8 and second lead layer providing a sense current that flows perpendicular to the planes of
9 the layers.

1 29. A magnetic storage device, comprising:
2 means for recording magnetic data thereon;
3 means for moving the means for recording magnetic data;
4 means for reading data on the means for recording magnetic data; and
5 means, coupled to the means for reading, for moving the means for reading
6 relative to the means for storing data, the means for reading further comprising:
7 means for providing a pinned layer;
8 means for providing a free layer;
9 means for providing a nickel nano-contact layer disposed between the
10 means for providing a pinned layer and the means for providing a free layer; and
11 means for providing a first and second lead layer disposed proximate to
12 the means for providing the pinned layer and free layer respectively, the means for
13 providing a first and second lead layer providing a sense current that flows perpendicular
14 to the planes of the layers.